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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/758,150	01/15/2004	Chee Hong Choi	20063/OG03-018	4636

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EXAMINER

LEE, CALVIN

ART UNIT	PAPER NUMBER
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2825

DATE MAILED: 11/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding*.

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Office Action Summary

Application No.

10/758,150

Applicant(s)

CHOI, CHEE HONG

Examiner

Lee, Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/5/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

OFFICE ACTION

Drawings

1. Figures 1a-1f are objected because they should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Specification

2. The disclosure is objected to because of the following informality:

Paragraph 0015 line 3, replace “an upper metal layer 14 and a dielectric layer 15” with --an upper metal layer 15 and a dielectric layer 14--. Correction is suggested.

Claim Rejections - 35 U.S.C. § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by *Kim* (US 2004/0137693).

Kim discloses a method for fabricating an MIM capacitor, comprising the steps of:

- depositing a dielectric layer 25 on a metal layer 23, which has been formed as a lower electrode 23a of an MIM capacitor 40 [Fig. 2A]
- removing some part of the dielectric layer to form the MIM capacitor thereon [paragraph 0024]
- depositing an MIM dielectric 29 and an upper metal layer 31 [Fig. 2B]
- forming the MIM capacitor by patterning the MIM dielectric and the upper metal layer [Fig. 2D]

Admittedly *Kim* is silent about a sacrificial layer. However, the Examiner notes that Applicant discloses “the sacrificial layer is used as an etch stopping layer ... silicon oxide or silicon nitride” [¶ 0014]. In *Kim*’s, “the dielectric layer 25 is [also] used as an etching stopper ... comprises an oxide film or nitride film” [¶ 0024]. Therefore, *Kim* inherently teaches or suggests a sacrificial layer 25, which is eventually removed a portion for subsequent deposition of the MIM. Just for reference, *Visokay et al* (US2004/0137693) suggests “a sacrificial layer 200, for example silicon nitride (Si₃N₄), this layer can acts as an etch stop during the recess etch” [Abstract].

Claim Rejections - 35 U.S.C. § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Kim*, as applied to claim 1, in view of *Applicant' Prior Art (APA)*.

Kim does not disclose such process steps as:

- forming a via hole by depositing and patterning an interlayer dielectric after forming the MIM;
- depositing a barrier metal layer on the via hole;
- filling the via hole with a metal;
- flattening the via hole; and depositing and patterning a metal layer.

Nevertheless, such interconnect on top of an MIM capacitor is known in the semiconductor processing art as evidenced by *APA* disclosing an interconnect comprising the steps of forming a via hole by depositing and patterning an interlayer dielectric 6; depositing a barrier metal layer 7; filling the hole with a metal plug 8; depositing and patterning a metal layer 9 on the flatten interconnect 8 [Figs. 1D-1F].

It would have been obvious to one having ordinary skill in the art to have modified the MIM formation of *Kim* by utilizing an interconnect on top for the purpose of electrically connect the MIM capacitor to the outside packaging lead.

7. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kim* and *APA*, as applied to claim 2, in view of *Noguchi et al (US 2004/0152256)*.

The combination of *Kim* and *APA* suggests neither the interconnect metal being selected from the group of tungsten, copper family elements, and platinum family metals, nor the barrier metal layer being made of a high fusion point metal or nitride thereof, and wherein the barrier metal layer is configured to have one of a single layer structure and a multi-layer structure.

a) In re claim 3, *Noguchi et al* discloses an MIM capacitor [¶ 0090] followed by an interconnect [Fig. 18 and ¶ 0098] having an interconnect metal 57 of copper or copper alloy.

It would have been obvious to one having ordinary skill in the art to have modified the metal material of *Kim* and *APA* by utilizing a copper metal for the purpose of better interconnectio

b) In re claim 4, *Noguchi et al* also discloses the MIM capacitor followed by the interconnect [Fig. 18 and ¶ 0098] having the interconnect metal 57 made on a barrier metal layer 56 (of the same material as the conductive barrier layer 18), i.e., high-melting point metal nitride such as WN, WSiN ... may be either a single layer film or a laminated film [¶ 0072].

It would have been obvious to one having ordinary skill in the art to have modified the barrier material of *Kim* and *APA* by utilizing a high-melting point metal nitride for the purpose of better suppressing or preventing diffusion of copper.

Contact Information

8. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896, Monday to Thursday, from 6:30 to 4:00 (ET). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* whose telephone number is (571) 272-1907.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The central fax number is (703) 872-9306 for all communications to be entered (e.g., amendments, remarks, IDS, etc.)



October 28, 2004